

MESH NETWORKSBACKGROUND of the INVENTION

In networks, such as telecommunication networks, fully meshed networks are often used to interconnect the nodes together and in particular to interconnect trunk exchanges. Although fully meshed networks can be of considerable use, they do have the characteristic that the more nodes there are in a fully meshed network, then the narrower the routes between nodes have to be once the switches are port limited. Doubling the nodes in a fully meshed network can halve the size of each route across the mesh. However, reducing the route size can increase the chance of blocking as well as reducing the Erlang efficiency.

In some telecommunication networks each fully meshed trunk exchange is also connected to several local exchanges, so that the longer distance trunk calls tend to traverse four exchanges namely a local, a trunk, a second trunk and a final local.

In such a network the local exchanges only need to know if a call originating on its own exchange cannot be terminated on its own exchange, in which case the call is forwarded to a trunk exchange.

For reasons of redundancy a local exchange is normally connected to more than one trunk exchange, in which case a call which cannot be terminated on its own exchange can probably be forwarded to any of the connected trunk exchanges.

However if the local exchanges are connected to more trunk exchanges than are needed for redundancy reasons, then the local exchange could be asked to perform part of the overall trunk routing algorithm. Consequently the intended final destination of the call can be used to decide to which trunk exchange the call should be sent to by the local exchange.

Provided the local exchange is able to route to more than one trunk exchange depending on the destination of the call, then it is possible to use a pair of trunk exchanges to perform the function of one existing trunk exchange, with approximately twice the capacity and throughput. This is assuming that the two exchanges each have the same or similar capacity to the existing trunk exchange. The existing trunk exchange can be one of the pair of trunk exchanges. The pair of trunk exchanges can be known as Siamese trunk exchanges.

A SUMMARY OF THE INVENTION

According to the present invention there is provided a telecommunications network comprising a plurality of mesh nodes, each mesh node including one or more switches, at least one of the mesh nodes including a plurality of switches, each mesh node having a connection to each other mesh node by means of a connection between a switch at the one mesh node and a switch at the other mesh node and each mesh node having associated therewith a respective plurality of local nodes, each switch of each mesh node being connected to all of the respective associated plurality of local nodes and including a network routing algorithm to control the routing in the network.

There is further provided a method of upgrading a telecommunications network, said telecommunications network comprising a plurality of mesh nodes, wherein each mesh node includes at least one switch, each mesh node having a direct connection to each other mesh

node by means of a connection between a switch at the one mesh node and a switch at the other mesh node and the switch or switches of each mesh node being each connected to all of a respective plurality of multiple local nodes, the method comprising the steps of :-

- (a) adding a further switch to at least one of the mesh nodes;
 - (b) connecting all of the respective plurality of local nodes to the further switch;
 - (c) providing a network routing algorithm to control the routing in the network;
- and
- (d) dividing the connections from the at least one mesh node to the switches of the other mesh nodes between the switch or switches and the further switch of the at least one mesh node.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described by way of example, with reference to the accompanying drawings in which:

Figure 1 shows an example of a network having a number of fully meshed mesh nodes;

Figure 2 shows an example of a fully meshed mesh node of the network shown in Figure 1 connected to multiple local nodes;

Figure 3 shows an example of a fully meshed mesh node of the network shown in Figure 1 with a single switch;

Figure 4 shows an example of a fully meshed mesh node of the network shown in Figure 1 with two unconnected switches;

Figure 5 shows an example of a fully meshed mesh node of the network shown in Figure 1 with two connected (Siamese) switches; and

Figure 6 shows an example of a network as shown in Figure 1 including a number of fully meshed mesh nodes where each node has two switches.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows an example of a network having fully meshed mesh nodes, such as trunk exchanges, where each mesh node is directly connected to every other mesh node. In practice these links are often carried by transmission systems.

In Figure 2 some of the mesh nodes (trunk exchanges) of Figure 1 are shown connected to multiple local nodes, such as local exchanges. In practice these connections are often carried by transmission systems. The connection of multiple local exchanges to trunk exchanges is a recognised telecommunication network configuration.

Recognized

Figure 3 shows a mesh node of Figure 2 containing a single switch. Such a switch could be a trunk exchange equipment. This switch is connected to all the other mesh Nodes as well as all the illustrated multiple Local Nodes. The illustrated Local Nodes may also be connected to switches at other mesh nodes.

Figure 4 shows the mesh node of Figure 3, to which has been added a further switch. Any added switches could be trunk exchanges. The direct links from the other mesh nodes are taken to one or the other, but not both, of the switches. The pair of switches are both connected to all the multiple local nodes associated with that mesh node. The local nodes have to be able to route calls or messages to the appropriate one of the pair of switches.

Figure 5 shows the mesh node containing two switches as in Figure 4, but with a connection (Siamese link) between them. If the connection between a local node and the switch that is normally used to route a call or message is congested, then if the connection to the other one

of the pair of switches is not congested then this connection and the Siamese link can be used in series, to avoid the congestion. The Siamese link is not essential, but can be a useful feature for practical networks.

Figure 6 shows an example of a network where all the Mesh Nodes each have two switches, each pair of switches within a mesh node being joined by a Siamese link. The overall result is that each switch is connected to approximately one half of the other mesh nodes and approximately one quarter of the other switches. For larger examples the approximations can be more precise, but there is no basic need to equally divide the routes between the mesh nodes and the switches. Some routes may naturally carry more traffic and some pairs of switches may not have identical characteristics to each other.

The network will require a network routing algorithm to control the routing of messages, of whatever form through the network.

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